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June 1, 1944

WOOD WASTE AVAILABLE FOR CONVERSION TO ALCOHOL
IN THE DURHAM AREA OF NORTH CAROLINA

by

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A FOREST SURVEY SPECIAL REPORT

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BOOK NUMBER 1.9622
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SUMMARY

In the Durham area of North Carolina there are 40 concentration yards of which 38 have a surplus of shavings available for alcohol. Normally these yards will have available 75,100 tons (oven-dry) per year or enough to produce 3.8 million gallons of alcohol. At the present war-time reduced rate of annual production, about 54,800 tons (oven-dry), sufficient for 2.7 million gallons, would be available.

Hauling by truck is required from only three plants, all within 15 miles from Durham. Transportation of a normal production of 3,900 tons (air-dry) annually would cost about \$0.99 per ton (oven-dry) or 2 cents per gallon of alcohol.

All of the remaining 35 plants are accessible by rail. No haul would exceed 60 miles and the transportation of a normal production of 80,200 tons (air-dry) annually would cost, at present intrastate rates, about \$1.49 per ton (oven-dry) or 3 cents per gallon of alcohol, providing shavings were baled or ground.

Loose shavings, such as blown directly from planer to a box car, weigh about 25,000 pounds per carload as compared with 35,000 pounds or more per car for baled or ground shavings. As present freight rates are based on a 35,000-pound minimum weight per carload, the transportation of loose shavings would cost more, \$2.02 per ton oven-dry or 4 cents per gallon. Contacts with representatives of major railroads indicate a strong possibility of a carload minimum weight reduction to 25,000 pounds, resulting in transportation costs similar to those cited for ground or baled shavings.

Waste available from sawmills would probably include only sawdust. In 1942, 116 mills within an approximate 40-mile radius from Durham produced 54,500 tons (oven-dry) of this material. This amount, when added to the quantity of shavings available annually from concentration yards would raise the supply of raw material to about twice the amount required for a 3-million gallon plant.

According to the Forest Survey, 17 counties surrounding Durham contained approximately 5.0 billion board feet of pine saw timber in 1937. In the six years from January 1, 1937, to January 1, 1943, the average annual drain of pine saw timber has been about 464 million board feet, while net growth has been only 341 million board feet, resulting in a net decrease in the pine growing stock of 123 million board feet per year. In the six-year period the pine stand decreased from 5.0 billion board feet to 4.3 billion, a net reduction of 15 percent. At this rate the pine saw timber will be rather scarce in 30 to 40 years.

WOOD WASTE AVAILABLE FOR CONVERSION TO ALCOHOL

IN THE DURHAM AREA OF NORTH CAROLINA

This report is an appraisal of the volume of southern yellow pine wood waste available for conversion to alcohol in the Durham area. Two other reports for areas in North Carolina have also been prepared. One of these covers the Raleigh area, which includes much of the Durham territory. The other report is for the Tarboro area which overlaps somewhat the territory included in the Raleigh report.

The determination of the quantity of wood waste available from concentration yards is based on detailed information obtained from most of the yards in the area. Estimates of sawmill waste are derived from data obtained from representative sample mills and from concentration yards. Also included are estimates of the cost of transporting wood waste by rail and truck. Inasmuch as timber supply may have an important bearing on the location of an alcohol plant, that phase of the problem is also presented.

THE AREA

On May 12 a preliminary report was made for a 12-county area within a 40-mile radius from Durham. In this report the same area is used for information pertaining to sawmills, but the concentration yard area has been adjusted to include all yards within a 60-mile rail haul of Durham. Yards accessible by truck only are limited to those with less than a 20-mile haul. Consequently, some of the yards previously reported on have been dropped and others have been added.

In general, the area resembles one of several suggested as a possible site for an alcohol plant by Dr. Egon Glesinger in his report on the utilization of wood waste in North Carolina. His decision was influenced by a relatively large production of lumber. Sawmill waste, except as a supplementary source of raw material, was a secondary consideration in our selection of this area. The primary reason for selecting this area is that it and the Raleigh area contain many more concentration yards than comparable areas elsewhere in the state. These yards produce large volumes of shavings--free from foreign material and of a low moisture content--most of which are available for alcohol. In addition, practically all yards are located on railroads, and shavings can be blown directly from the planer into box cars with a minimum outlay for equipment. With some additional expense, the shavings can be baled or ground up with hammer mills to increase the shipping weight per car. On the other hand, only a few sawmills in the area are stationary and located on railroads. The majority are of a portable type (accessible by truck only), have barely enough power to produce rough lumber, and average only about 100,000 board feet per set. Therefore, the problem of loading and transporting waste from sawmills is much more complicated than at concentration yards.

SURVEY PROCEDURE

Within the adjusted Durham area there are 40 concentration yards--one more than included in the preliminary report. These yards assemble rough lumber from portable mills and, after air or kiln drying, trim and plane practically all of it for shipment. Some is also resawed. The largest item of waste is shavings, with "blocks" resulting from trimming and sawdust from resawing distinctly secondary. During April and May, 34 of the yards included in this report were contacted and information obtained concerning the quantity of waste that might be available from each. (See appendix form for detail of information obtained.) Averages from 43 plants contacted in and adjacent to the area were used as a basis for estimating the quantity of wood waste available at the six yards not visited.

Sawmill data were obtained from mills within and adjacent to the area and applied to the population as averages. (See appendix form for type of information collected at sawmills.) In addition, the information obtained from individual mills was supplemented by data collected at concentration yards. Inasmuch as the yards control the operations of about 2 to 10 mills each, they are considered reliable sources of information regarding the size of logs, quantity of lumber sawed per set, thickness of lumber sawed, and waste disposal practices at portable mills.

WASTE AVAILABLE

Concentration yards: All but one of the yards visited had developed a fuelwood market for the short pieces of boards resulting from trimming; consequently, this class of waste material is not considered further in this report. Sawdust resulting from resawing operations is largely accounted for in the waste estimate for shavings, particularly as to quantity and disposal practices.

Only one of the 34 yards contacted in the area used all of their shavings for generating power, and only one yard had a buyer for surplus shavings. The remaining plants all had planer waste in excess of their power requirements. Five of the plants contacted were powered by Diesel motors and two plants were operated by electricity; therefore, all shavings produced at these plants were available for alcohol. The average for the area shows that about two-thirds of shavings produced are not utilized at the concentration yards.

The disposal of shavings is a serious problem at practically all plants contacted. As a result of the past year's coal shortage, some of this waste is being used at nearby laundries and other small plants. Some is also being used by farmers for poultry litter. Most of the surplus shavings are destroyed by burning at the yards, but in some cases they are accumulated in huge piles (figure 1). At the majority of yards shavings constitute a serious fire hazard, and operators would welcome a market merely to reduce the danger from fire. An important point to consider is the fact that many yards operate by steam power, as a means of

Figure 1. - About a 2-year accumulation of shavings at a Diesel-powered concentration yard located at Creedmore, N. C. Tree to right of pile is about 50 feet in height.

aiding in the disposal of waste, and would be very susceptible to a changeover to Diesel or electric power, thereby substantially increasing the amount of shavings available for alcohol.

Table 1 shows for the 40 concentration yards the shipments of dressed pine lumber, the cubic feet of solid air-dry wood removed from

Table 1. - Summary of pine shavings production at concentration yards in Durham area of North Carolina.

Item	Unit	Number of units	
		1943	Normal year
Concentration yards	No.	40	40
Shipments of planed pine lumber	M bd.ft.	235,300	341,600
Air-dry wood converted to shavings	Cu. ft.	4,948,000	7,175,000
Used at yards	"	1,752,000	2,794,000
Available for alcohol	"	3,196,000	4,381,000
Oven-dry weight of shavings	Tons	84,900	123,000
Used at yards	"	30,100	47,900
Available for alcohol	"	54,800	75,100
Probable alcohol yield	Gals.	2,740,000	3,755,000

the lumber in the form of shavings, and the oven-dry weight of the shavings. These data are presented for a normal or peace-time year as well as for 1943. If all surplus shavings were collected and utilized for alcohol, approximately 2.7 million gallons could be manufactured annually from current reduced war-time production, and 3.8 million gallons from the output of a normal year.

TRANSPORTATION OF SHAVINGS

Of the total tonnage (air-dry weight) of shavings available from concentration yards in a normal year, only 3,900 tons or 5 percent would be from three plants requiring truck haul. Table 2 shows the estimated cost of hauling this material to be \$0.99 per ton oven-dry weight or 2 cents per gallon. The estimate assumes fairly rapid loading from overhead bins at the yards, and unloading at plant by mechanical means. The average load would approximate 5 tons, which can easily be hauled by a 1½ to 2-ton truck equipped with a semi-trailer. Per mile truck costs used are those set forth in the schedule of standard operation, repair, and depreciation rates for Region 8, U. S. Forest Service. These rates approximate those of local commercial truckers.

Table 2. - Estimated truck transportation cost of shavings from concentration yards requiring truck haul in Durham area of North Carolina.

Yard location	Dist. from Durham	Est. quantity of shavings available in a normal year		Possible alcohol prod.	Truck transportation cost		
		Air-dry weight	Oven-dry weight		Total	Per oven-dry ton	Per gal. of alcohol
	<u>Miles</u>	<u>Tons</u>	<u>Tons</u>	<u>Gals.</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Cents</u>
Carrboro	15	1,900	1,700	85,000	2,318	1.36	2.7
Hillsboro	13	300	270	13,500	336	1.24	2.5
Durham	3	1,700	1,520	76,000	816	0.54	1.1
All locations	-	3,900	3,490	174,500	3,470	0.99	2.0

Thirty-five yards producing shavings available for alcohol are accessible by rail (figure 2). In a normal year approximately 80,200 tons of air-dry shavings, 95 percent of the total, may be obtained from these yards. Table 3 shows the shipping points and the estimated quantity of shavings which may be shipped in a normal year, or currently as indicated by the 1943 tonnage.

As a result of contacts with representatives of several of the major railroads servicing the area, it is found that the prevailing intrastate freight rates on sawdust and shavings are the same as those for lumber and based on a carload minimum weight of 34,000 pounds (see appendix). Table 4 presents the estimated costs of rail transportation based on these rates. It should be noted that separate costs are shown for ground or baled shavings and for loose shavings. The reason for this is that baled shavings or shavings ground with a hammer mill will weigh 34,000 pounds or more per car, while loose shavings blown from the planer into a box car will weigh only about 25,000 pounds. Consequently, the movement of loose shavings by rail is more costly.

From information on hand it appears that the price which might be paid the concentration yards for shavings may not be sufficient to justify the installation of extra equipment for baling or grinding shavings. It appears that the best solution is the establishment of a lower minimum carload weight, 25,000 pounds, for shavings and sawdust on intrastate shipments. If this is accomplished with all railroads concerned, the per ton and gallon costs as shown in table 4 for baled or ground shavings would also apply to loose shavings. Discussions with some of the railroads indicate that a lower minimum weight per carload is quite possible particularly when the outbound transportation of alcohol is considered. Minor railroads, which may not participate in the transportation of the alcohol, might not be willing to accede to a lower minimum weight. At this stage of planning, however, it is impossible to foresee the attitude of the smaller railroads.

Table 3. - Railroad shipping points and estimated tonnage of shavings available annually from concentration yards in Durham area of N. C.

Distance by rail <u>Miles</u>	Shipping point	Quantity of shavings ^{1/}	
		1943 <u>Tons</u>	Normal <u>Tons</u>
20 or less	Creedmore	4,100	5,300
	Morrisville	1,200	1,700
	Total	<u>5,300</u>	<u>7,000</u>
21 to 30	Apex	1,100	1,900
	Raleigh	2,400	4,600
	Total	<u>3,500</u>	<u>6,500</u>
31 to 40	Graham	200	300
	Moncure	900	1,700
	Youngsville	2,900	2,600
	Oxford	1,800	2,500
	Roxboro	9,100	14,100
	Millbrook	800	800
	Fuquay Springs	1,200	1,700
	Angier	3,100	4,600
	Total	<u>20,000</u>	<u>28,300</u>
41 to 50	Henderson	2,200	3,300
	Pittsboro	3,100	4,800
	Clayton	1,400	2,500
	Sanford	1,900	1,900
	Total	<u>8,600</u>	<u>12,500</u>
51 to 60	Goldston	4,000	4,700
	Olivia	200	800
	Smithfield	200	200
	Broadway	-	600
	Jonesboro	2,200	2,200
	Norlina	7,100	7,100
	Greensboro	4,700	6,900
	Pleasant Garden	2,300	3,400
	Total	<u>20,700</u>	<u>25,900</u>
Total all points		58,100	80,200

^{1/}Based on air-dry condition of shavings.

Table 4. - Estimated rail transportation cost of shavings in a normal year from concentration yards within indicated rail distances of Durham, North Carolina.^{1/}

Rail dist.	Rail transportation cost									
	Est. quantity of shavings available annually		Possible alcohol production	Ground or baled shavings ^{2/}			Loose shavings ^{4/}			
				Total	Per oven-dry ton	Per gal. of alcohol	Total	Per oven-dry ton	Per gal. of alcohol	
	Air-dry weight ^{2/}	Oven-dry weight	Dollars							Dollars
	Miles	Tons	Tons	Gals.	Dollars	Dollars	Cents	Dollars	Dollars	Cents
20	7,000	6,300	315,000	6,300	1.00	2.0	8,540	1.36	2.7	
30	13,500	12,100	605,000	13,450	1.11	2.2	18,290	1.51	3.0	
40	41,800	37,300	1,865,000	50,240	1.35	2.7	68,381	1.83	3.7	
50	54,300	48,500	2,425,000	67,740	1.40	2.8	92,131	1.90	3.8	
60	80,200	71,600	3,580,000	106,590	1.49	3.0	144,967	2.02	4.0	

^{1/}Based on Tariff Authority, Agent Hoke's ICC 543 for single or joint line application (34,000 lbs. minimum carload weight).

^{2/}Approximates shipping weight and exceeds oven-dry weight by about 10.7%.

^{3/}Carload weight of ground or baled shavings approximates 34,000 lbs.

^{4/}Carload weight of loose shavings as from planer approximates 25,000 lbs.

SAWMILL WASTE

Sawmills: In addition to 40 concentration yards in the Durham area, there are 116 sawmills within approximately a 40-mile radius of Durham producing one million or more board feet annually (figure 3). In 1942, the last year for which complete statistics are available, these mills produced a total of 162.8 million board feet of southern yellow pine. In table 5 is presented the estimated amount of waste produced by these mills and the quantity that might be available annually for an alcohol plant to supplement that obtained from concentration yards.

Table 5. - Estimated quantity of pine waste from sawmills in Durham area of North Carolina.

County	Saw-mills ^{1/}	1942 production of pine lumber	Estimated quantity of waste produced	Estimated quantity of waste available		
				Sawdust	Slabs & edgings	Total
	No.	M bd.ft.	Tons ^{2/}	Tons ^{2/}	Tons ^{2/}	Tons ^{2/}
Alamance	2	2,180	2,881	835	878	1,713
Caswell	5	6,717	8,878	2,575	2,705	5,280
Chatham	19	24,348	32,009	8,481	8,957	17,438
Durham	5	6,540	8,644	2,508	2,634	5,142
Franklin	6	10,807	14,052	2,979	3,195	6,174
Granville	11	17,813	23,362	5,921	6,271	12,192
Harnett	10	16,170	20,912	3,894	4,221	8,115
Lee	9	10,950	14,472	4,198	4,410	8,608
Orange	6	6,535	8,637	2,506	2,632	5,138
Person	14	18,366	24,273	7,042	7,397	14,439
Vance	4	5,380	7,110	2,063	2,167	4,230
Wake	25	37,008	48,373	11,482	12,214	23,696
All counties	116	162,814	213,603	54,484	57,681	112,165

^{1/}Includes only mills producing 1 million board feet or more in 1942. Mills producing more than 25% hardwood not included.

^{2/}Oven-dry weight.

The difference of 101,500 tons between the amount of waste produced and available is chiefly the result of a good market for slabs and edgings for domestic fuel. Prices paid for this material as fuelwood ranged from \$2.00 to \$6.00 per cord at the mill site. Slabs and edgings not sold for fuel or used for power are chiefly those from portable mill operations located away from roads or those produced in the summer season when fuelwood requirements are comparatively low. Furthermore, practically all mills having a surplus of slabs and edgings do not have sufficient power to operate a hog. Consequently, in addition to a hog, each mill would require a supplemental power unit if slabs and edgings in a ground-up form are needed. Few, if any, could stand the expense of this additional equipment at the probable prices to be paid for the waste. In consideration of these factors, it is deemed advisable not to

consider as raw material for an alcohol plant, the 58,000 tons of slabs and edgings available at sawmills.

The situation is different in respect to sawdust for practically all of it is available. Very little is used for power or hauled away for other purposes. The chief difficulties associated with the procurement of sawdust for alcohol would be the development of mechanical means for loading trucks and the establishment of economic hauling rates. If a market for sawdust developed, it is believed that these problems could be readily overcome, and the 54,000 tons of available sawdust would raise the total amount of raw material to approximately twice the amount needed for a three-million gallon plant.

TIMBER SUPPLY

A primary factor that must be considered is the future timber supply available to the concentration yards and sawmills. In a large measure these plants must depend upon the timber grown within and adjacent to the area, for extending their range of operations would merely encroach upon plants already established elsewhere.

According to the Forest Survey, 17 counties surrounding Durham contained approximately 5.0 billion board feet of pine saw timber in 1937. In the six years from January 1, 1937, to January 1, 1943, the average annual drain of pine saw timber has been about 464 million board feet, while net growth has been only 341 million board feet, resulting in a net decrease in the pine growing stock of 123 million board feet per year. In the six-year period the pine stand decreased from 5.0 billion board feet to 4.3 billion, a net reduction of 15 percent. At this rate the pine saw timber will be rather scarce in 30 to 40 years.

A P P E N D I X

Date _____

By _____

CONCENTRATION YARD

Name _____ Address _____

Steam _____ Electric _____ Diesel or Gas _____

Dressed pine output:

Normal _____ MBM, % 1" _____, % 2" _____, % 2"+ _____, % D&M _____

1943 _____ MBM, % 1" _____, % 2" _____, % 2"+ _____, % D&M _____

Average width & length of: 1" _____, 2" _____, D&M _____

Use of waste on annual basis - %

Use	Sawdust	Trims	Shavings	
Power				
Sold				
% Unavailable				
Burned at plant				
Accumulated at plant				
Given away				
% Available				

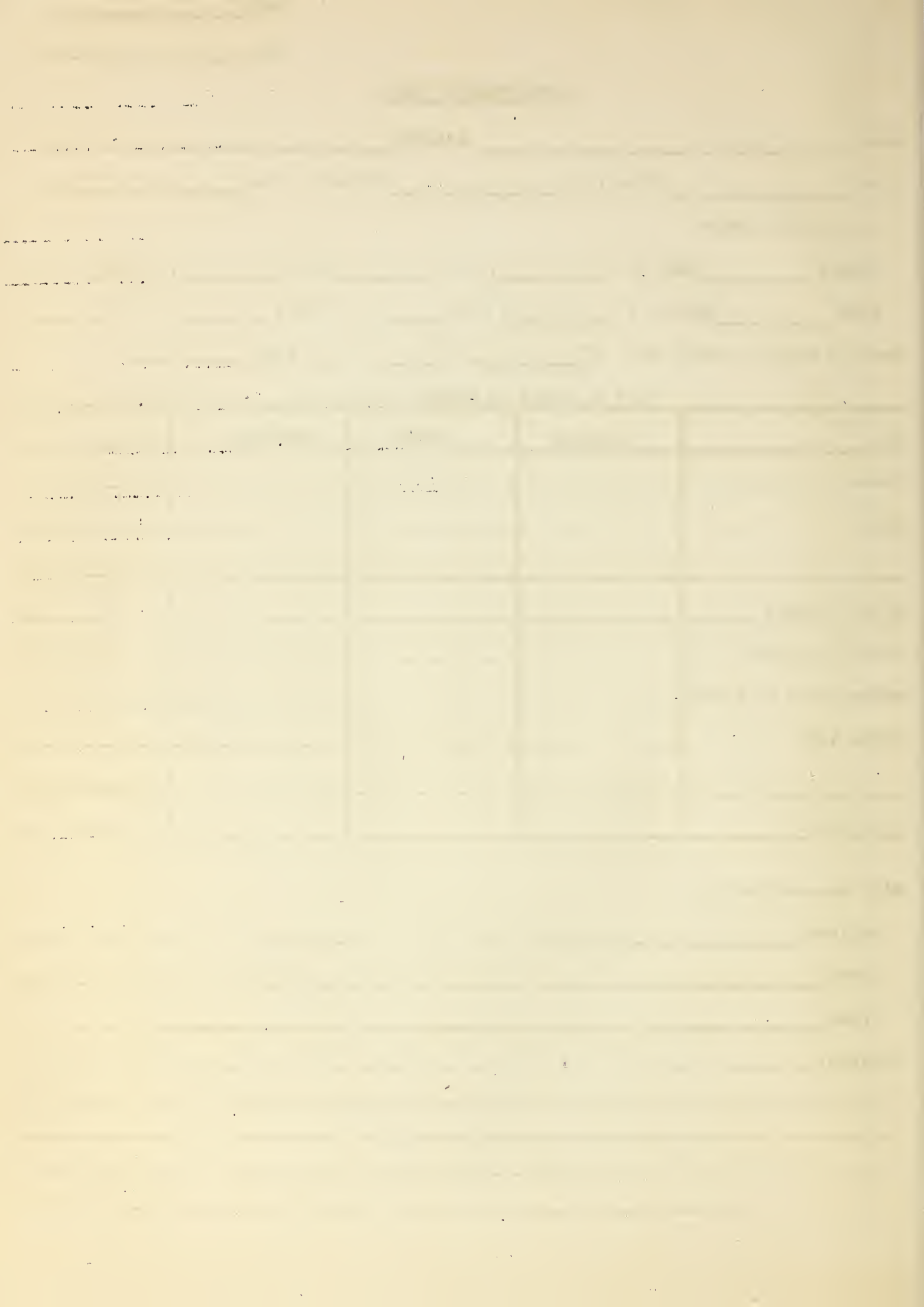
Mill accessible by:

Railroad _____

Barge _____

Truck _____

Remarks: _____



SAWMILL

Date _____
By _____

Name _____ Address _____

Accessible by: truck _____, RR _____, barge _____

Type: portable _____, stationary _____

Power: steam _____, Diesel or gas _____, Electric _____, H.P. _____

Saw: circular _____, band _____, kerf _____

Other equipment: edger _____, cutoff _____, trimmer _____

resaw _____, planer _____, hog _____

Total pine output:

Normal _____ MBM, % 1" _____, % 2" _____, % 2"+ _____

1943 _____ MBM, % 1" _____, % 2" _____, % 2"+ _____

Dressed pine output:

Normal _____ MBM, % 1" _____, % 2" _____, % 2"+ _____, % D&M _____

1943 _____ MBM, % 1" _____, % 2" _____, % 2"+ _____, % D&M _____

Averages of: Logs: diameter _____, length _____, No. per iBM _____

Lbr.: 1" _____, 2" _____, 2"+ _____ D&M

Use of waste on annual basis - % P-H

Use	Sawdust	Slabs	Edgings	Trims	Shavings	
Used for power						
Sold for fuelwood						
Sold for pulp						
Used by employees						
Claimed by timber owner						
% Unavailable						
Destroyed by burning						
Left at mill site						
Given away						
% Available						

Rates on Sawdust and Shavings
Carload Minimum Weight 34,000 pounds^{1/}

<u>Miles</u>	<u>Present rates</u> <u>in cents per</u> <u>100 pounds^{2/}</u>	<u>Miles</u>	<u>Present rates</u> <u>in cents per</u> <u>100 pounds^{2/}</u>
Not over		Not over	
20	4 $\frac{1}{2}$	200	14 $\frac{1}{2}$
30	5 $\frac{1}{2}$	210	15
40	6 $\frac{1}{2}$	225	16
50	7	250	17
60	7 $\frac{1}{2}$	275	18
70	8	300	19
80	8 $\frac{1}{2}$	325	20
90	9	350	21
100	9 $\frac{1}{2}$	375	22
110	10	380	23
120	10 $\frac{1}{2}$	400	24
130	11	420	25 $\frac{1}{2}$
140	11 $\frac{1}{2}$	440	26 $\frac{1}{2}$
150	12	460	27 $\frac{1}{2}$
160	12 $\frac{1}{2}$	520	28
170	13	560	29
180	13 $\frac{1}{2}$	600	30
190	14	640	31
		660	32

1/ Applies on:

Sawdust, viz:

Wood sawdust, as from the saw.

Wood sawdust, as from the saw, ground.

Wood shavings, unground, and wood sawdust, as from the saw,
physically mixed.

Wood shavings, ground.

Wood pieces, ground.

Wood dust, sanding machine.

Shavings, unground, in bags, in machine pressed bales or in
bulk (for shaving, ground see sawdust).

Shingle tow (shingle shavings) in bags, in machine pressed
bales, or in bulk.

Note 1 - Applicable only on commodities listed under sawdust
of which not more than 75 percent of weight will pass through
a No. 60 U. S. Bureau of Standards screen.

2/ Rates apply for single or joint line application. Tariff Authority,
Agent Hoke's ICC 543.

